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EXAMINER

DO, CHAT C

ART UNIT

PAPER NUMBER

2124

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Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/507,521

Applicant(s)

XIE ET AL.

Examiner

Chat C. Do

Art Unit

2124

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 2/10/00; 4/13/00; 6/13/00; 2/5/02.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-28 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-28 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 10 February 2000 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 4.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

## **DETAILED ACTION**

### ***Information Disclosure Statement***

1. The information disclosure statement filed February 5 2002 fails to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each U.S. and foreign patent; each publication or that portion which caused it to be listed; and all other information or that portion which caused it to be listed. It has been placed in the application file, but the information referred to therein has not been considered.
2. The information disclosure statement filed February 5 2002 fails to comply with the provisions of 37 CFR 1.97, 1.98 and MPEP § 609 because the provided list of art is irrelevant to the present invention. It has been placed in the application file, but the information referred to therein has not been considered as to the merits. Applicant is advised that the date of any re-submission of any item of information contained in this information disclosure statement or the submission of any missing element(s) will be the date of submission for purposes of determining compliance with the requirements based on the time of filing the statement, including all certification requirements for statements under 37 CFR 1.97(e). See MPEP § 609 ¶ C(1).

### ***Specification***

3. Applicant is reminded of the proper language and format for an abstract of the disclosure.

The abstract should be in narrative form and generally limited to a single paragraph on a separate sheet within the range of 50 to 150 words. It is important that the abstract not exceed 150 words in length since the space provided for the abstract on the computer tape used by the printer is limited. The form and legal phraseology often used in patent claims, such as "means" and "said," should be avoided. The abstract should describe the disclosure sufficiently to assist readers in deciding whether there is a need for consulting the full patent text for details.

The language should be clear and concise and should not repeat information given in the title. It should avoid using phrases which can be implied, such as, "The disclosure concerns," "The disclosure defined by this invention," "The disclosure describes," etc.

4. The abstract of the disclosure is objected to because the abstract is written as two paragraphs. Correction is required. See MPEP § 608.01(b).

5. The disclosure is objected to because of the following informalities:

It is unclear how the error equation (7b) can be obtained in line 8 page 7.

In addition, it is unclear how the most right term of equation (9) can be obtained by subtracting equation (7b) from equation (6) in line 13 page 7.

Appropriate correction is required.

#### *Claim Rejections - 35 USC § 112*

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claims 1-28 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Re claim 1, the natural logarithm is notated with  $\log(x)$ . However, the scientific notation for the natural logarithm is  $\ln(x)$ . For the examination purpose, the examiner considers all the logarithm function  $\log(x)$  as the natural logarithm function. In addition, in line 1 of claim 1 claims a method for computing a natural logarithm function.

However, the present invention is used only for computing an approximation of a natural

logarithm function. Therefore, the examiner only considers this method as the computation of an approximation of a natural algorithm function.

Claim 15 has the same problem.

***Claim Rejections - 35 USC § 101***

8. 35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

9. Claims 1-7 and 15-21 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.

Claims 1-7 clearly recite a method for calculating the approximation of a natural logarithm function according to a mathematic algorithm. Claims 15-21 recite an apparatus implementing the above process but fail to limit the apparatus to any particular structure other than a general computer with input, memory, and processing devices. Indeed, any apparatus used to implementing the underlined process would result in an apparatus as claimed. In order for such a claimed method, computer-related process, or a claimed non-specified apparatus implementing the underlined process to be statutory, the claims must include either a step or means that results in a physical transformation outside the computer or a limitation to a practical application. However, it is clear from the claims that the claims merely recite step or non-specific means for data computation and manipulation in performing a mathematical function. The input is a number and output is also a number. The claims fail to recite any step or means that results in a physical transformation outside the computer, that includes a limitation to a practical

application, or that requires a specific computer to implement the claimed process.

Therefore, claims 1-7 and 15-21 are clearly directed to a non-statutory subject matter.

***Claim Rejections - 35 USC § 103***

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

11. Claims 1-3, 7, 15-17, and 21 are rejected under 35 U.S.C. 103(a) as being obvious over Smith (U.S. 5,570,310) in view of Watson (U.S. 5,629,780).

Re claims 1 and 15, Smith discloses a method in Figure 3 for computing (equation 10) for a natural logarithm function. The method comprises the following steps: partitioning of mantissa (col. 3 lines 65-67 and col. 4 lines 1-5 where  $i$  is the index of that sub-region as described in equation 13) between 1 and 2 into  $N$  equally spaced sub-regions, precomputing  $a_i$  (col. 4 lines 17-18) of each of  $N$  equally spaced sub-regions where  $i = 0$  to  $N-1$ , selecting  $N$  sufficiently large (col. 4 lines 1-10) so that the first degree polynomial in computation of  $\log(m)$  within a preselected degree of accuracy, and computing (abstract) a value of  $\log(x)$  for binary floating point representation of a particular number  $x$  stored in a memory of a computing device. Smith does not disclose the precomputing point  $a_i$  is the centerpoint of each of the sub-region. Smith does not disclose the computation of approximation of  $\log(x)$  using first degree polynomial in  $m$ . However, Watson discloses a method of determining a value using a mid-point within a

region for minimizing the error (col. 10 lines 30-35). In addition, it is well known in the art to use Taylor series to approximate a value. In order to minimize the computation process, the approximation of  $\log(m)$  using Taylor series is utilizing the first degree polynomial of the Taylor series. Therefore, it would have been obvious to a person having ordinary skill in the art to use first order Taylor series to approximate the  $\log(m)$  function and using the mid-point  $a_i$  as the preference point because it would reduce the computation time and the region error.

Re claims 2-3, 7, 16-17, and 21, Smith discloses the method in Figure 3 for computing a natural logarithm function wherein the input number  $x$  (col. 1 lines 58-65) has a binary exponent in addition to the binary mantissa  $m$ . Smith discloses the steps of computing a value of  $\log(x)$  by partitioning a mantissa  $m$  of binary representation of  $x$  in a memory (220 and 260) and precomputed value of  $\log(a_i)$  (280). Smith does not directly disclose that the  $\Delta x$  is computed from mantissa  $m$  to reference mid-point  $a_i$  and the computation of  $\log(x)$  using a polynomial of first degree in  $m$ . However, Watson discloses a method of determining a value using a mid-point within a region for minimizing error (col. 10 lines 30-35). In addition, it is well known in the art to use Taylor series to approximate a value. The equation in claim 3 is the first order approximation of  $\log(m)$  using Taylor series where  $\log(m) = \log(a_i) + \Delta x/a_i$ . Therefore, it would have been obvious to a person having ordinary skill in the art to use first order Taylor series to approximate the  $\log(m)$  function and using the mid-point  $a_i$  as the preference point because it would reduce the computation time and the region error.

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12. Claims 8-9 and 22-23 are rejected under 35 U.S.C. 103(a) as being obvious over Smith (U.S. 5,570,310) in view of Wallschlaeger (U.S. 5,345,381).

Re claims 8-9 and 22-23, Smith discloses the above method for computing a natural logarithm function. Smith does not disclose that method can be utilized in a computed tomography scanner as in image reconstructor for generating an image of an object from acquired projection data of the object. However, Wallschlaeger discloses the use of logarithm function (col. 1 lines 35-40) in a computed tomography scanner (Figure 1) as in image reconstructor (col. 1 lines 25-35) for generating an image of an object by manipulating the intensity values (Figure 3). Therefore, it would have been obvious to a person having ordinary skill in the art to use the method of logarithm function in tomography scanner as in image reconstructor for generating an image of an scanned object because the Smith's logarithm function method would yield faster results and less error.

13. Claims 10-11 and 24-25 are rejected under 35 U.S.C. 103(a) as being obvious over Smith (U.S. 5,570,310) in view of Wallschlaeger (U.S. 5,345,381) in further view of Watson (U.S. 5,629,780).

Re claims 10-11 and 24-25, Smith in view of Wallschlaeger discloses the method in for computing a natural logarithm function in tomography scanner wherein the input number  $x$  (col. 1 lines 58-65) has a binary exponent in addition to the binary mantissa  $m$ . Smith in view of Wallschlaeger discloses the steps of computing a value of  $\log(x)$  by partitioning a mantissa  $m$  of binary representation of  $x$  in a memory (220 and 260) and precomputed value of  $\log(a_i)$  (280). Smith in view of Wallschlaeger does not directly



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disclose that the  $\Delta x$  is computed from mantissa  $m$  to reference mid-point  $a_i$  and the computation of  $\log(x)$  using a polynomial of first degree in  $m$ . However, Watson discloses a method of determining a value using a mid-point within a region for minimizing error (col. 10 lines 30-35). In addition, it is well known in the art to use Taylor series to approximate a value. The equation in claim 3 is the first order approximation of  $\log(m)$  using Taylor series. Therefore, it would have been obvious to a person having ordinary skill in the art to use first order Taylor series to approximate the  $\log(m)$  function and using the mid-point  $a_i$  as the preference point because it would reduce the computation time and the region error.

#### ***Allowable Subject Matter***

14. Claims 12-14 and 26-28 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, second paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

#### ***Conclusion***

15. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

- a. U.S. Patent No. 5,546,333 to Smith discloses a data processor having a data table for performing a dual function of alphanumeric notice and numerical calculations.
- b. U.S. Patent No. 5,184,317 to Pickett discloses a method and apparatus for generating mathematical functions.

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c. U.S. Patent No. 5,951,629 to Wertheim et al. discloses a method and apparatus for log conversion with scaling.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Chat C. Do whose telephone number is (703) 305-5655. The examiner can normally be reached on M => F from 7:00 AM to 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chaki Kakali can be reached on (703) 305-9662. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 746-7239 for regular communications and (703) 746-7238 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-3900.

Chat C. Do  
Examiner  
Art Unit 2124

September 30, 2002



**CHUONG DINH NGO**  
**PRIMARY EXAMINER**